REMARKS

Review and reconsideration on the merits are requested. An Information Disclosure Statement is filed herewith. A DECLARATION UNDER 37 C.F.R. § 1.132 is filed herewith.

Applicants amend claim 17 by incorporating claim 19 therein and by further reciting ", whereby when said papers subjected to inkjet printing, ink attached to a paper surface quickly penetrates into the inside of the paper while suppressing ink dots formed by ink drops on the paper surface from spreading".

With the above amendments, claims 19 is canceled and claim 20 is amended from "wherein said sizing agent further comprises a surfactant and an inorganic filler." to --wherein said sizing agent further comprises an inorganic filler.--.

The newly added limit to claim 17 finds support at page 13, lines 18-19 and page 19, lines 9-12 in the specification.

Applicants now address and traverse the rejection of claims 17, 19 and 20 under 35 U.S.C. § 103(a) based on U.S. Patent 4,908,240 Auhorn et al (Auhorn), noting that claims 17/19 have been combined.

Since the features which establish patentability of the present invention are recited in claim 17 (amended), in the following paragraphs only claim 17 (amended) is discussed and referred to as claim 17.

Claim 17 is brief, and the Examiner is requested to refer thereto.

In the Office Action of October 24, 2003, the Examiner stated in Paragraph 4:

> "Auhorn discloses a coating agent (for paper to improve printability) consisting of (a) pigment, (b) cationic aqueous polymer dispersion and (c)

surfactant. A part of (b) is replaced by water-soluble polysaccharides (col. 7, lines 23-29). In col. 8, lines 59-62, patentee describes a paper coated with the coating agent.

Patentee does not specifically mention soybean polysaccharide. It is however obvious to one of ordinary skill in the art to choose any polysaccharide including the (claimed) soybean polysaccharide."

Auhorn discloses a process for improving the printability of paper by applying an aqueous coating agent consisting of pigments and binders to one or both surfaces of the paper and drying the coated paper. The aqueous coating agent is a mixture of:

(a) 100 parts by weight of a finely divided pigment;

(b) from 5 to 70 parts by weight, based on polymer, of a cationic aqueous polymer dispersion of a paper size, whose polymer has a glass transition temperature of 5° to 80°C; and

(c) from 0.01 to 10 parts by weight of a surfactant which interferes with the formation of the surface size, and/or of a polymeric dispersant, the same used as the coating agent in an amount of from 0.5 to 4 g/m^2.

Auhorn also teaches that up to 90, preferably, 5 to 30%, by weight of polymer component (b) can be replaced by a water-soluble polysaccharide, and that although component (b) is a typical cationic surface size for paper, the *sizing action* of the size is virtually completely *eliminated* but, surprisingly, the printability of the paper thus treated is substantially improved (emphasis added) (see Auhorn column 1, line 65 to column 2, line 18).

Applicants believe that the above disclosure in Auhorn means or implies that polymer component (b) including a water-soluble polysaccharide does not act as a sizing agent in the above discussed Auhorn aqueous coating agent consisting of components (a) + (b) + (c).

Applicants respectfully submit that what Auhorn quote clearly actually teaches to one of ordinary skill in the art is that *suitable* polysaccharides are water-soluble starches, carboxymethylcellulose, methylcellulose, hydroxyethylcellulose and galactomannanes (Auhorn, column 7, lines 26-29).

However, Auhorn *fails to teach or suggest* the use of a sizing agent comprising a water-soluble soybean polysaccharide extracted from soybeans or a soybean extraction residue which has been subjected to desalinating purification. Despite the above precise teaching in Auhorn, the Examiner still states in Paragraph 5, line 5 of the Action, that "polysaccharide of Auhorn does encompass soybean polysaccharide."

In order to demonstrate the difference between a ***sizing agent*** comprising a water-soluble soybean polysaccharide per the present invention and an aqueous ***coating*** made in accordance with Example 2 in the Table of Auhorn with respect to fixing and color development of ink on a paper surface and to establish the unexpectedly superior features of the present invention over Auhorn, Applicants submit herewith for the Examiner's consideration a DECLARATION UNDER 37 C.F.R. § 1.132 (The DECLARATION).

Following Example 2 of Auhorn, Comparative Example is presented in the DECLARATION. In accordance therewith, Digested cationic starch was not used, rather, Cationic dispersion 2 component (b) was used in an amount of 40 parts by adding an extra amount thereof (an extra 6.7 parts by weight).

A raw paper having a basis weight of 70 g/m^2 is coated with a sizing agent or an aqueous coating agent having a composition as shown in RUN No. 1 or RUN No. 2 of Table 1 by a coater

similar to a sizing press system coater, which corresponds to one conventional step in paper manufacture. The coating was in an amount of 5 g/m^2 on a solid basis. The product was then dried at 120°C for five minutes in an oven. In this regard, although an aqueous coating agent made in accordance with Example 2 of Auhorn had a solids content of about 25% by weight (Auhorn, column 12, lines 22-28), an aqueous coating agent thus prepared was too viscous to be coated on raw paper using the coater of the present invention which was constructed by Applicants' assignee.

Accordingly, an aqueous coating agent containing solid components in an amount of 2.0 parts by weight was used, as shown in RUN No. 2 of Table 1 which is set forth below.

Table 1

Composition of Sizing Agent (parts by weight on a solid basis)

RUN No.	1(7)[*1)]	2[*2)]
China Clay[(1)]	--	100
Na Salt of Polyacrylic Acid[(2)]	--	0.5
Water-Soluble Soybean Polysaccharide[(3)]	1.2	--
Cationic Polymer[(4)]	1.2	--
Digested Cationic Starch	--	--
Cationic Dispersion 2[(5)]	--	33.3 +6.7
Alumina[(6)]	0.6	--
Surfactant[(7)]	0.3	--
Total of Solid Components	3.3	140.5
Solid Component Used in an Aqueous Solution	3.3	2.0
Water	96.7	98.0

Note:

(*1) EXAMPLE, which corresponds to EXAMPLE No. 7 in Table 1 of the specification.

(*2) COMPARATIVE EXAMPLE disclosed in Auhorn, Example 2 in Table 2.

(1) Tradename "AA Kaolin," available from Fuji Talc Ind., Ltd.

(2) Tradename "ARON T-40" Available from Toagosei Co. Ltd.

(3) Tradename "Soyafive S-DN," available from Fuji Oil Co., Ltd.

(4) Viscous cationic polymer obtained by polymerizing a mixture of 70 parts by weight of N,N-dimethylaminoethyl acrylate-methyl chloride and 30 parts by weight of dimethyl acylamide in a 15% concentration.

(5) Prepared by the procedure described at column 10, lines 30-49 of Auhorn

(6) Easily sinterable, low-sodium alumina (Tradename "AES-12"), from Sumitomo Chemical Co., Ltd.).

(7) Nonyl phenol ("Browman N-509", HLB of 12.8, from Aoki Oil Industrial Co., Ltd.).

Recording papers thus obtained in RUN No. 1 and RUN No. 2 were used for full color printing using an inkjet printer (color bubble-jet printer "S600", from Canon Inc.).

The printed samples were evaluated with respect to color development, water resistance, feathering, bleeding and ink fixation. Color development was measured using a spectrophotometer ("NF-333" from Nippon Denshoku Industries Co., Ltd.). Weather resistance was evaluated using the naked eye to view image blurring on a sample immediately after printing that had been fixed at an angle of 45° on which 750 μl of water had been dropped.

The evaluation standards of the water resistance were as follows:

◎: Completely no blurring.

○: Slight elution of ink into the water, with no blurring of ink on the paper.

△: Slight blurring of ink on both surfaces of the paper.

X: Extreme blurring of ink on both surfaces of the paper.

Feathering was evaluated, by viewing with the naked eye, image blurring of the portion of the fine lines of each printed chart which was obtained.

Bleeding was evaluated by measuring, using the naked eye, image blurring between Red and Black and Yellow and Black, respectively.

Ink fixation was evaluated by slipping a fully black printed portion under a load of 40 g/m^2.

The results are shown in Table 2 below and printed papers, namely color copies are attached to the DECLARATION as (A) and (B).

Table 2 Results of Evaluation

No.	Color Development of Ink				Water Resistance
	Red	Yellow	Blue	Black	
EXAMPLE (A)*1) (RUN No. 1)	1.124	0.851	1.136	1.310	◎
COM. EX. (B)*2) (RUN No. 2)	1.087	0.762	1.076	1.393	X

Note: *1) See Sheet NCA-107-8 (A).

*2) See Sheet ex 2-1 (B).

It is respectfully submitted that Table 2 makes it clear that in EXAMPLE (A) using the sizing agent of the present invention excellent color development is achieved in red, yellow and blue dyes, black pigment being an exception. In this regard, it is noted that the difference in measure values between EXAMPLE (A) and COMPARATIVE EXAMPLE (B) in hundreds is within measurement errors.

In simple terms, this means that the sizing agent of the present invention is particularly effective for improving ink fixing and the color development of dyes.

Further, in EXAMPLE (A) which is coated using the sizing agent of the present invention, water resistance was greatly improved as compared to COMPARATIVE EXAMPLE (B) where coating was with the aqueous coating agent of Auhorn. Applicants believe that the unexpectedly advantageous features of the sizing agent of the present invention using a water-soluble soybean polysaccharide per the present invention over of using an aqueous coating agent

per Auhorn in water resistance can easily be seen by comparing the back surfaces of both printed papers (A) and (B). Note especially that in the back surface of printed paper surface (A), no ink blurrng whatsoever is observed.

With respect to the feathering, bleeding and ink fixation testing, printed paper (A) does not at first glance seems to be amazingly superior to printed paper (B) and all of these three tests. Applicants believe that one reason for this phenomenal or result is probably due to the raw paper used not having an uniformly plane surface, i.e., the raw paper was prepared on a laboratory scale without using the necessary additives and machines as would be used in commercial mass production.

Applicants believe that the unexpectedly superior results obtained in accordance with the present invention over Auhorn above discussed are due to a synergistic effect of the water-soluble soybean polysaccharide, the cationic polymer and the surfactant in the sizing agent of the present invention. This is explained in the present specification at page 3, line 12 to page 4, line 12 and illustrated in Fig. 1 to Figs. 2(a) and 2(c) of the present application.

In more detail, in accordance with the present invention the addition of the cationic polymer to the sizing agent enhanced fixing and color development of ink. Applicants believe that the water-soluble soybean polysaccharide of the present invention attracts the cation of the cationic polymer having a minus-charged main chain. This results in pseudo-crosslinking between the water soluble soybean polysaccharide and the cationic polymer in the sizing agent, as illustrated in Fig. 1 attached hereto.

If one were only to coat a cationic polymer on paper, most of the cationic polymer would permeate into the interior of the paper. However, when a pseudo-crosslinked product of the water-soluble soybean polysaccharide and the cationic polymer is formed (the system of the present invention), the cationic polymer remains on the paper surface without permeating or penetrating into the interior of the paper, resulting in improved ink fixing and color development even with a small amount of cationic polymer. The Examiner is requested to refer to page 3, lines 12-24 of the present specification and the data regarding red, yellow and blue dye colors of EXAMPLES 6-7 in the column "Color Development of Ink" of Table 2 at page 16 of the specification in view of the data regarding the red, yellow and blue colors of dyes in the column "Color Development of Ink" in Table 2 above, as well as Figs. 2(a) to 2(c) attached hereto.

The effect of the polysaccharide in combination with the cationic polymer has been above discussed. To improve the water resistance of images, a surfactant is added to the system of the present invention. The reason why the surfactant improves the water resistance of the (recording) paper is not completely clear, though Applicants presume or believe that dye is insolubilized by the reaction shown in Fig. 2 attached hereto. Analyzing this particular effect in more detail, it is believed or presumed that dye is insolubilized by the reaction shown in Fig. 2 attached hereto. First, the hydrophobic group in the side chains of the water-soluble soybean polysaccharide has affinity for the hydrophilic portion of the surfactant. The surfactant thus attaches to the side chains of the water-soluble soybean polysaccharide so that the hydrophilic portion of the surfactant protrudes outwardly, as shown in Fig. 2(a). Further, because the hydrophilic portion of the surfactant will become close to the hydrophilic portion of the dye

contained in the ink, the dye becomes close to the water-soluble soybean polysaccharide. See Fig. 2(b). Thus, dye is closely attracted to the cationic polymer which is pseudo-cross-linked with the water-soluble soybean polysaccharide, whereby dye is insolubilized due to bonding between the cation portion of the cationic polymer and the anion portion of the dye; see Fig. 2(c) and page 3, lines 25 to page 4, line 12 with page 17, lines 2-4 in the specification and the evaluation in the column entitled "Water Resistance" in Table 2 of the specification (at page 16) in view of the evaluation in the column "Water Resistance" in Table 2 above presented herein as well as both printed papers, specifically Sheet NCA-107-8 (A) and Sheet ex 2-1 (B).

In short, the unexpectedly advantageous features of the sizing agent of the present invention which comprises a water-soluble soybean polysaccharide as compared to the aqueous *coating agent* of Auhorn with respect to water resistance are believed or presumed to be due to the synergistic or multiplication effect of the water-soluble soybean polysaccharide, the cationic polymer and the surfactant in the sizing agent of the present invention.

In more detail on this point, the water-soluble soybean polysaccharide in the sizing agent of the present invention plays a very substantial role in insolubilization of dyes in the recording paper when the recording paper is subjected to inkjet printing. Ink attached to the paper surface quickly penetrates into the interior of the paper while there is a suppression of ink dots formed by ink drops on the paper surface from spreading, thereby permitting the art to obtain an inexpensive recording paper which is excellent in ink concentration, color development and water resistance, which will yield a high quality image free from blurring and visibility from the

rear surface of the paper. Such a product is thus particularly and especially suitable for full color inkjet printing; see page 17, lines 5-9 of the present specification.

The data establish that in contrast to the present invention, the aqueous *coating agent* made an accordance with the Example 2 of the Table in Auhorn does not give a recording paper having "Water Resistance" which is anywhere equivalent to that of the *sizing agent* of the present invention.

The unexpected superiority in Water Resistance obtained in accordance with the present invention is because the aqueous *coating agent* of Auhorn consists of pigments and binders and was developed to improve the printability of any raw paper, which raw paper is uncoated and which raw paper has not been subjected to any other conversion procedures. See specifically column 1, line 65 to column 2, line 1 and column 2, lines 22-24 of Auhorn. This is quite distinct from the *sizing agent* of the present invention which provides inexpensive recording papers of excellent ink concentration, color development and water resistance, as compared to the binders in an Auhorn system, namely component (b) of the cationic aqueous polymer dispersions of Auhorn, which is/are a typical cationic surface size for papers. See especially column 2, lines 14-15 and lines 46-50 in Auhorn, where such materials are clearly stated and taught not to have any function to insolubilize a dye in a recording paper.

In conclusion, Applicants respectfully submit that the *sizing agent* of the present invention is established by the data in the DECLARATION to be unexpectedly superior to the aqueous *coating agent or solution* made in accordance with Example 2 of Auhorn with respect to

ink concentration, color development and water resistance on recording paper use, benefits nowhere suggested as achievable in Auhorn.

Applicants thus respectfully submit that, assuming the Examiner has posed a proper *prima facie* case of obviousness based on Auhorn, since Auhorn fails to teach or suggest any significant role of the water-soluble soybean polysaccharide used in the sizing agent of the present invention, one of ordinary skill in the art would not be motivated to reach the invention as recited in claim 17 (amended) and, accordingly, claim 17 (amended) is not rendered obvious by Auhorn.

The patentability of claim 20 is believed clear from the above arguments.

Summarizing the DECLARATION submitted herewith, Applicants respectfully believe that the same establishes that the *sizing agent* of the present invention is unexpectedly superior to an aqueous *coating agent* made in accordance with Example 2 of Auhorn with respect to ink concentration, color development and, most especially, water resistance on recording paper use, and this is the case even though the aqueous *coating agent* used and made in accordance with Example 2 of Auhorn does *not contain* component (c) in accordance with the present invention, namely a surfactant.

Interviews were conducted with the Examiner concerning this application, the substance of the interviews being what showing should be made in a DECLARATION to be convincing.

The substance of that interview is set forth below.

The Examiner granted two interviews concerning this application. In the first interview, the Examiner required about 30 comparisons from U.S. Patent 4,908,240 Auhorn et al (Auhorn).

In the second telephone interview, however, the Examiner suggested the following general approach for comparisons.

It is not necessary to use "Digested cationic starch" in any comparison.

It would be acceptable to use AA Kaolin as China clay and ARONT-40 as the salt of polyacrylic acid.

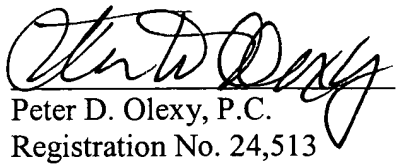
The starting point would be claim 1 of Auhorn, with elements (a), (b) and (c) applied in an amount as claimed, elements (b) and (c) amount falling about in the middle of the range, if possible. Example 2 seemed to be acceptable to Examiner Rajguru.

With respect to Auhorn at column 7, lines 23-29. Examiner Rajguru felt that the best comparison, would involve a certain proportion of component (b) being replaced by one or more water-soluble polysaccharides. Water-soluble starches seemed logical, but there does not appear to be any specific preference in Auhorn except for the potato starch at column 5, lines 8 et seq., and that seems to be a copolymerization modifier, not a water-soluble starch in the sense of column 7, line 23 et seq. of Auhorn. The next point was now much of component (b) to replace. Column 7, line 23 uses a maximum of 30% by weight but claim 2 uses a maximum of up to 90% by weight replacement. The Examiner would not commit to which maximum % should be used.

One issue was: what would the comparison run or runs representing the present invention be? This point was not discussed in detail with the Examiner.

Withdrawal of all rejections and allowance is requested.

Respectfully submitted,



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